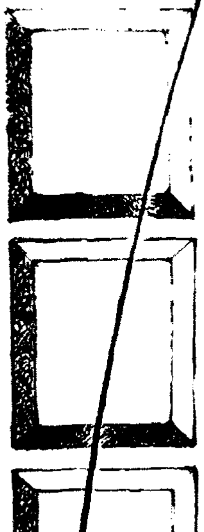
IMAGERY ARCHITECTURE 2000

THE EYES OF GLOBAL POWER

Maj Charles B. Harvey



Errata Sheet
for
Harvey, *Imagery Architecture 2000: The Eyes of Global Power*

Please note the following corrections:

Page 6, line 4 fr bot: Change "UAVs" to "These resources".

Page 11, para. 2 fr bot: "SPOT" is misidentified. In actuality, it is a French imaging satellite--*Satellite Pour l'Observation de la Terre*--whose products are commercially available.

Page 16, para. 3, line 3: With the recent elimination of specified commands, the definition for the acronym *UMRS* would now be "unified/major command receive segment."

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Imagery Architecture 2000
The Eyes of Global Power

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This publication has been reviewed by security and policy review authorities and is cleared for public release.

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Foreword

The end of the cold war has signaled the opening of a new global political realm that will present new challenges to replace those we faced in the bipolar world. As emerging nations prosper and become more competitive, accompanying political, diplomatic, and military conflict must be expected. Accordingly, we must be prepared to counter threats to our national interests and challenges to our world leadership position. This environment, coupled with declining defense resources, imparts to us a clear need for a sense of urgency in our efforts to monitor international events and observe foreign political and military activities. Our goal should be to foster a global environment that is consonant with those values and institutions we cherish. Where our efforts are less than successful, we must have the ability to engage other nations across political, diplomatic, and military spectrums and resolve conflict on our terms.

A world where the only certainty is uncertainty places extraordinary demands on our intelligence community. We must give our people the tools to provide intelligence support for mission demands across the spectrum from peace to war. Intelligence distribution is a valuable asset we cannot overlook as we influence the international environment in terms of our national vision and global interests. We must not accept the alternative of responding to the will of others as we move forward into the next century.

RONALD R. FOGLEMAN
General, USAF

About the Author

Maj Charles B. Harvey

Maj Charles B. Harvey was commissioned in the Air Force in 1979 after earning a bachelor's degree in political science from the University of New York at Albany. He completed the imagery intelligence officer basic course at Lowry Air Force Base (AFB) in Colorado and the Defense Sensor Interpretation and Training Program at Offutt AFB, Nebraska. Major Harvey then served as an imagery analyst at the National Photographic Interpretation Center in Washington, D.C. In 1984 he was assigned to the deputy chief of staff/intelligence at Headquarters, Fifth Air Force, at Yokota Air Base (AB), Japan, and in 1986 became the chief of defense cooperation. In 1987 Major Harvey was assigned to the 548th Reconnaissance Technical Group at Hickam AFB, Hawaii, as the director of the Exploitation Division. In 1990 he assumed command of the 6306th Reconnaissance Technical Flight at Osan AB in the Republic of Korea. Two years later, Pacific Air Forces selected Major Harvey to serve as a command-sponsored research fellow and to attend Air Command and Staff College. Major Harvey is currently assigned to the Army–Air Force Center for Low Intensity Conflict at Langley AFB, Virginia. He is married to the former Judith Martin of Phoenix, Arizona.

Preface

I had the privilege of serving in the Pacific in several imagery support roles, and came away convinced that there must be a better way to provide robust imagery support not only to Pacific Air Forces (PACAF), but to all the supporting elements of the United States Pacific Command (USPACOM). Imagery dissemination systems fielded through the last decade served a purpose, but within a narrow scope. Each suffered from the inability to interconnect with other imagery dissemination systems, and most could not deploy with any semblance of speed. The staff at Headquarters Pacific Air Forces provided me with outstanding support in fielding and operating imagery dissemination systems, but the staff's voice did not always prevail when multiple agencies, tasked to serve a larger community, designed and procured the systems. I offer this document not only to those in the imagery systems field but to others in imagery systems, operations, and production organizations as well. It is intended not as criticism of the past but as a guide for future imagery intelligence dissemination system design, procurement, and operation.

I am grateful for the unending support that made this project possible. I am particularly indebted to Capt Allan Sadowski, SMSgt Mark Olsen, and SMSgt Randy Johnson (retired) who provided me with outstanding support during my tenure in the Pacific. The staff at the Airpower Research Institute conducted an excellent orientation and training program, and Lt Col Thomas Nowak provided exceptional support to the command-sponsored research program as sponsor, mentor, and facilitator. Dr Lewis Ware, my research advisor, consistently delivered an exceptional level of support. Ms Marion Gorrie, in Air University Press, earned my sincere thanks for converting my draft to a readable document.

I sincerely appreciate the confidence expressed by Gen Jimmie V. Adams and Maj Gen Malcolm Armstrong in presenting me with the opportunity and challenge to undertake this project.

I join many others who are deeply indebted to Lt Col Steven Alber, USAF, Ret, for his singular leadership and wise counsel. He imparted to Pacific Air Forces and the United States Pacific Command a clear sense of direction for imagery intelligence support to combat operations. The results of his leadership are officers who understand mission support and a quality benchmark for the Department of Defense imagery intelligence community.

My profound gratitude goes to my wife Judy, whose untiring support and unending patience made this effort possible and enjoyable.

Charles B. Harvey

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Introduction

History has shown the advantage of integrating Air Force forces with those of other services/nations. Our vision of Global Reach/Global Power requires that we organize, train, and equip our forces to allow rapid deployment of exceptionally capable joint/combined forces. . . . We must always keep sight of our mission—working together to create combat airpower to apply anywhere in the world in order to fly, fight, and win!

—Gen John M. Loh, commander, Air Combat Command (ACC),
Preamble to ACC Regulation 2-1

The end of the cold war and the bipolar focus of US military power introduced new uncertainties in the efforts to fathom the nature and source of future threats to American interests and in the posture defense forces should assume. Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force*, addresses the vagaries in national security defense requirements. "We do not know what threats the United States will face in the future, where Americans will face them, or against whom the United States might have to apply military force."[1] Continued access to resources and markets, geopolitical alliances and commitments, and the inherent requirements of global leadership make it essential that the US be continuously able to adapt effectively to changes in the environment in each region of the world. Accordingly, one of the four cornerstones in the US defense strategy is forward presence. "Although the changing global environment allows us to reduce our permanent foreign deployments, some US forces must remain deployed overseas in areas of US interest. The forward presence of US forces makes for more credible deterrence, promotes regional stability, and provides us an initial capability for crisis response and escalation control."[2] A key aspect of this challenge is the ability to defend worldwide military, political, and economic interests and commitments. Accordingly, US forces must be postured to respond to crises with immediacy and propriety, with an objective being to control escalation and resolve conflicts on terms favorable to the US and its allies.

These considerations foreshadowed a new, more dynamic defense posture that gave our armed forces a decidedly regional perspective. The reorganization of the Department of Defense, directed in the Goldwater-Nichols Act, emphasized the role of the theater commanders in chief as the focal point in applying the military instrument of national power to challenges to United States interests.[3]

The study will present challenges from new directions, particularly given the current status of developing nations, emerging powers, and nonstate actors. Some of those nations possess nuclear weapons, others, a variety of weapons of mass destruction with formidable means of delivery. As the United States seeks to pursue peaceful interaction with other like-minded nations, it must be ever vigilant against those that may seek to disrupt or destabilize the international environment through violence. Part of that vigilance requires a military instrument capable of immediate and adequate response, and, when necessary, preemptive action to protect US interests and obligations to allied nations.

Imagery intelligence provides an essential ingredient in the ability to predict threats and hostile intentions, avert hostile actions, prevent conflict, and prevail over adversaries with minimal impact upon US forces and assets. Successful application of intelligence to support those activities requires that it be timely, accurate, and sufficient. The following chapters illustrate shortfalls in intelligence support to military planning and operations and offer an architecture intended to provide optimal multidiscipline intelligence support to all aspects of military planning and operations.

Notes

1. Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force*, March 1992, 2, 233.

2. Reprinted excerpts from *Statement of the Secretary of Defense, Dick Cheney, Before the House Appropriations Defense Subcommittee, in Connection with the FY 92–93 Budget for the Department of Defense*, 19 February 1991. Cited from *Fundamentals of Force Planning 2, Defense Planning Cases*, edited by the Force Planning Faculty, Naval War College, 19.

3. Lt Col Thomas T. LoPresti, *The JCS System Before and After Goldwater-Nichols* (Carlisle Barracks, Pa.: US Army War College, May 1991), 35–36.

Chapter 1

Imagery Intelligence and Military Operations

A Historical Perspective

Rather plain signs of tracks indicate however some activity. It is quite necessary for us to get a good airplane picture of this group of batteries soon, particularly so they can be bombarded with certainty.

—German Artillery Report for April 1917,
Reconnaissance Flight 39

Aerial reconnaissance has made extraordinary strides in terms of technological advances and capabilities since its humble beginnings expressed in a captured German photo interpretation report written in April 1917. After all major military and naval operations and wars through the decades following this report, imagery intelligence support has been the subject of thorough review at all levels of command. Although imagery provided many extraordinary contributions to mission success, a recurring theme is that imagery did not meet the ultimate user's requirements in terms of quality, quantity, or timeliness. Nor did these contributions ensure imagery's use as an effective contributor to the planning process or in the conduct of combat operations. This chapter examines some of the factors involved in imagery shortfalls and discusses an architecture intended to counter those shortfalls.

The technology frontier has advanced to the degree that imagery dissemination architecture can be designed to significantly improve the quality and quantity of imagery delivered to the end user. That architecture must meet numerous demands and satisfy stringent command requirements before it can be declared adequate. An examination of historical shortfalls in providing imagery intelligence support to users must precede discussion of imagery dissemination requirements. The following case studies illustrate gaps in the ability to adequately disseminate imagery intelligence to support contingency users where and when they needed it. Also made clear is a trend of inadequate levels of technology applied to systems needed to facilitate intelligence support to military operations. This lack of integrated architecture negatively impacted the US government's ability to apply military force to events demanding an immediate response. The results of these case studies can be applied to current missions as well as conceivable military operations in support of US interests in many other parts of the world.

Inchon Landing

One example of a significant imagery shortfall became apparent in the early stages of planning for the Inchon landing in Korea—the planners realized that no imagery existed of the intended landing area. Amphibious landings have inherent uncertainties that raise the risk level. Reconnaissance products have the potential to negate some of the risk, but planners must provide the means to procure the resources. It was only because representatives from the Air Materiel Command were in the theater to conduct a review of reconnaissance support capabilities that the US Navy requirements were quickly communicated to the 8th Tactical Reconnaissance Squadron (TRS).[1] The reconnaissance shortfall came as no surprise considering the economic pressures in early 1949. With the exception of one tactical reconnaissance group-equivalent, all tactical reconnaissance units were inactivated.[2] Col Jacob W. Dixon, commander of the 8th TRS, had perceived a false economy, and in summary of lessons from the Korean conflict wrote that

> Since one of the most critical times in reconnaissance requirements is that period at the very outbreak of hostilities, I feel that our military effort was weakened greatly by trying to save money on reconnaissance between wars and then not having the equipment available in the using organizations when the demand was the most critical.[3]

Vietnam

Asian terrain, theater size, and the nature of the war in Southeast Asia combined to present a compelling need for rapid delivery of imagery intelligence support to combat units. The diversity of combat forces and the forces' respective missions being serviced compounded the challenges encountered in meeting support demands. Each US service had unique imagery intelligence demands. There also existed a diverse set of locations in Southeast Asia, including naval combatants offshore, where perishable intelligence information was essential to successful mission planning and poststrike mission assessment.

> With the increased military effort in Southeast Asia, there was a corresponding increase in intelligence requirements and resources during 1965. Procedures were developed within the theater to insure rapid dissemination and distribution of intelligence derived from multi-sensor imagery being produced by the 2d Air Division. A regularly scheduled T-39 courier run was initiated to transmit this material from the 15th Reconnaissance Task Force Photo Processing Center, Udorn, Thailand, to the 13th RTS [Reconnaissance Technical Squadron] at TAN SON NHUT. When received at the 13th RTS, the original negative was duplicated and forwarded to the 13AF, and PACAF for further duplication and distribution to the intelligence community. The T-39 courier service was also used to distribute this material to the 2d Air Division strike units located in Thailand and South Vietnam. As the buildup continued, the 460th TRW [Tactical Reconnaissance Wing] was activated at TAN SON NHUT and the 432nd TRW was activated at Udorn. By October 1966, the

13 RTS was at 7th Air Force Headquarters as the primary processing and interpretation squadron in South Vietnam.[4]

Over the next two years, the imagery reconnaissance situation deteriorated. Army requests actually diminished during 1967; the number of days required to satisfy high-priority requests drove Army users to rely upon the Mohawk reconnaissance system.[5] The Army ultimately raised the problems with reconnaissance support to the commander in chief, Pacific Air Forces (Gen John D. Ryan), who, in a message to the commander, Seventh Air Force (Gen William W. Momyer), commented:

> Army requests for Air Force reconnaissance, especially on high priority targets, continue to diminish. It appears that the Marines also tend to rely more on Mohawk coverage rather than our reconnaissance. Records [at] this headquarters reveal that reconnaissance requests for Army have in fact been on decline for months. . . . Primary reasons for decline in requests apparently based on generally slower Air Force response time.[6]

A key element in the problem of timeliness was the state of technology during that period. Optical cameras flown aboard aircraft on reconnaissance missions acquired imagery of the objective areas. The film was subsequently downloaded and processed in a "wet" photographic laboratory and exploited by imagery analysts, and the extracted information was sent out in a message. Additionally, couriers delivered imagery products to users. The process tended to be manpower intensive, and it required a variety of technical skills. The close of the war in Southeast Asia did not witness any remarkable changes in imagery support to combat users.

Mayaguez

It was not long before reconnaissance was once again required to support a military operation. Cambodian forces seized the SS *Mayaguez* on the high seas, and the events that unfolded highlighted the need to move imagery rapidly to combat users. The *Mayaguez* crew became the subject of hostile action shortly after 1400 on 12 May 1975. The ship's captain stated that a US Navy P-3 flew over his ship at approximately 1600 that afternoon.[7] The P-3, not equipped for imagery reconnaissance roles, was not able to provide adequate evidence of the location of the ship's crew or intelligence of defenses in areas subject to future naval and military action. On the day following the seizure, a U-2 was flown on a reconnaissance mission over the area to which the Cambodians had taken the *Mayaguez*. Mission film, however, had to be processed in Hawaii. It was sent to Hickam AFB, Hawaii, by way of Andersen AFB, Guam, taking over two days for the trip. (The KC-135 carrying the film on the final leg of the trip was diverted to support refueling operations related to *Mayaguez* recovery operations.[8]) Only then could the process of exploiting the imagery and production and dissemination of imagery products from the U-2 begin. RF-4s were also tasked against the *Mayaguez*, and their imagery had to be processed in Thailand. Although the delays for the RF-4's imagery were not as protracted as those in the case of the U-2, they did negatively impact the value of the imagery for this fast-moving scenario.

A significant challenge confronting the intelligence community was moving intelligence information and imagery products, once available, to the forces participating in the attempt to rescue the crew. Responding forces included Marines deployed by air from Okinawa, the carrier USS *Coral Sea*, positioned at that time in the Coral Sea, and helicopters and security police from within Thailand. Within two days, the amphibious carrier USS *Hancock* was deployed from the Philippines.[9] It became apparent that intelligence support was less than optimal.

US Marine officers queried two of the HH-53 pilots prior to mission launch and during the flight for details of the latest status of their mission.[10] Col Loyd Anders, Jr., deputy commander (operations), 56th Special Operations Wing, had no intelligence information available to him upon his arrival at Utapao, and only written message traffic became available after the mission launch, even with a day's delay.[11]

Though there may remain unresolved divergences of views in the level of support, the commander in chief, United States Pacific Command, reacting to the draft General Accounting Office report on the *Mayaguez*, stated that "comments on communications highlight the very real and pressing requirement for improved, modern, secure, long-range communications within PACOM."[12]

Eldorado Canyon

In the decade that followed, the United States was destined to become involved in more military operations. Libyan sponsorship of international terrorism demanded a powerful, timely response, which materialized in the form of a bombing attack on Libya on 14–15 April 1986. Although the challenges of an extraordinarily long mission presented significant obstacles, the planning process also involved salient considerations. The number of F-111s was increased twice during the planning process, then spare aircraft were added to the mission package.[13] Planning also had to encompass US naval operations—14 A-6Es were launched from the USS *America* and USS *Coral Sea* as part of the overall strike package.[14] Thus, the scenario presented challenges in moving target imagery between planners at the Joint Staff, US Air Forces Europe, and the Sixth Fleet. Had this been an operation requiring follow-on air strikes during the succeeding days, the imagery community would have faced formidable obstacles in meeting imagery requirements for battle damage assessment and generation of new targets.

Earnest Will Reflagging Operations

In 1987, events in the Middle East compelled the United States to embark on an operation to ensure the safety of tankers operating in the Persian Gulf. Crude oil tankers reflagged with American flags conducted the Earnest Will operation. The US issued strong warnings of retaliation if the Iranians attacked the tankers. During the course of the operation, US troops were airlifted into the region, and many of them transited Diego Garcia. Had events during the operations led to large-scale hostilities, an optimal avenue in preparing US forces for combat operations and airlifters for mission planning would have been to transmit intelligence data to those forces via the airlifters as they transited into the theater. Voice satellite communication equipment serviced the airlift operation that moved a US Marine Corps minesweeping detachment from Norfolk Naval Air Station to Diego Garcia. However, the support was inadequate for mission requirements. Nearly all of the command, control, and mission information passed over unsecure communication links.[15] Finished intelligence information and products could not have been passed in quality or quantity had the need arisen.

Grenada Operations

Time is a factor that presents a formidable barrier to effectively carrying out short notice operations. Despite well-intended planning, time remains a concern, and it exacerbates problems associated with discharging global responsibilities. Events in Grenada illustrated the impact of time upon a desired course of action where a potentially hostile regime threatened US citizens. Intelligence collectors had to gather information quickly but not so openly as to compromise the element of surprise. In reflecting upon the rapid chain of events, the commander of 21st Air Force said that "nobody had ever heard of Grenada. We were all at MAC [Military Airlift Command headquarters, Scott AFB, Illinois] at a commanders' conference when the crisis arose on that Friday night. . . . We didn't know for sure then just where we would stage from and how we would do the job."[16] Neither the ground forces being airlifted into the Caribbean nor the ingressing aircrews could be provided with a timely flow of high-volume imagery intelligence, which would have been beneficial in securing Barbados as a staging area and in gaining control of Grenada. Overall, "There were some real serious deficiencies in command and control and communications."[17]

The recurring theme in the actions outlined was that a significant need existed for compiled, finished intelligence products. A common thread in each case was the time required to move imagery products to the staff agencies and combat units being supported. Each post–Vietnam scenario offered precious little time with which to stage forces and build intelligence data bases. Each had a fast-moving scenario and, with the exception of Grenada, was far from the borders of the United States. Grenada was a little-studied part of the Caribbean, and accordingly, presented an operational area where relatively few US military personnel had any expertise.

Desert Shield/Desert Storm

Operations Desert Shield and Desert Storm presented a continuation of the difficulties inherent in moving imagery products to planners and operational users. Specific complaints have focused upon the shortfall in delivery of the high volume of imagery products required by the operational user for mission planning and by the theater commander for use in prosecuting the campaign.[18]

Imagery Sources

A variety of sources produced imagery, including manned aircraft, unmanned drones, and satellites. By 24 August 1990, U-2 reconnaissance aircraft were included in the force structure in Southwest Asia, providing imagery of Iraq and Kuwait.[19] Other aircraft tasked to provide imagery support included the US Air Force RF-4C and the US Navy F-14 carrying the tactical air reconnaissance pod system (TARPS).[20]

Multiservice Operations

The US Army, Navy, and Marine Corps operated the Pioneer unmanned aerial vehicle (UAV) system part of whose mission was to support near-real time reconnaissance, surveillance target acquisition, battle damage assessment, and battlefield management.[21] The constellation of national reconnaissance resources included the land satellite (LANDSAT), which provided multispectral imagery for operations planning and strike preparation.[22]

Examination of the complexity and geographic diversity inherent in theater imagery production provides insight into the challenge of moving imagery to the user. The U-2R was operated from At-Taif, but the reconnaissance film was flown to Riyadh for exploitation. Similarly, the RF-4C was based at Shaikh Isa, Bahrain, and the imagery from its sensors was also flown to Riyadh.[23] Diversity was a challenge from the US naval operations perspective as well. "The F-14s were deployed aboard five of the six carriers in theater and operated from the Red Sea and the Persian Gulf."[24] The US Navy Pioneer UAV operating bases included the USS *Missouri* and USS *Wisconsin*, the US Army's UAV platoon had to support requirements throughout the VII Corps area, and three Marine Corps remotely piloted vehicle companies operated from the Al-Jubai airport, Abu Hadriyah, Al-Mish'ab, and Al-Qarrah.[25]

UAVs offer the theater commander excellent organic imagery capabilities and, from the theater viewpoint, necessary redundancy and flexibility. A significant challenge arises, however, in moving imagery quickly and without degradation to the user. In Desert Storm, the 926th Tactical Fighter Group and the 706th Tactical Fighter Squadron personnel found that "imagery often arrived late or was of such poor quality that the material could not be used for BAI [battlefield air interdiction] mission planning or for inflight purposes."[26]

The Defense Department's final report to Congress, in commenting on intelligence, states that "support to tactical commanders was sufficient, but suffered from a lack of available assets and difficulties in disseminating national and theater intelligence. This was aggravated by numerous incompatible secondary imagery dissemination systems in theater."[27] Battle damage assessment capabilities were also criticized on a number of fronts, but the essential function of providing results to the users was a significant shortfall.

It is clear that many important advances have been made in some areas in the reconnaissance community, including imagery quality, space-based reconnaissance systems, digital links to airborne sensors, and UAVs. It is equally apparent that steps must be taken to advance capabilities in the area of imagery storage, retrieval, and dissemination. The next chapter considers imagery users in terms of missions and respective imagery intelligence requirements.

Notes

1. Col George W. Goddard, *History of Air Materiel Command Support of the Far East Air Force in the Korean Conflict, June–November 1950*, 4, 8 November 1950, 15.
2. *United States Air Force Operations in the Korean Conflict, 25 June–1 November 1950*, USAF Historical Study 71, 1 July 1952, 97.
3. Ibid., 98.
4. *Intelligence Activity Input, Task: Intelligence Dissemination*, 1 January 1962 to 31 March 1968 (Headquarters, Pacific Air Forces: Deputy Chief of Staff/Intelligence), 75.
5. Ibid., 76.
6. Maj Denis J. Haney, May 1971, *Tac Recon Support of Other Services in SEA*, commander in chief, Pacific Air Forces, message 290012Z May 1968. Cited from *CORONA HARVEST, An Examination of the USAF Reconnaissance Support for Surface Forces in South Vietnam*.
7. Capt Charles T. Miller, testimony before House Committee on Internal Affairs, Subcommittee on International, Political, and Military Affairs, 25 July 1975.
8. *The SS Mayaguez Seizure: An Evaluation of Intelligence Factors*, commander, 548th Reconnaissance Technical Group, Hickam AFB, Hawaii, 17 June 1975.
9. David R. Mets, *Land-Based Air Power in Third World Crises* (Maxwell AFB, Ala.: Air University Press, July 1986), 42–43.
10. Capt Barry W. Walls and Capt Paul L. Jacobs, 40th Air Rescue and Recovery Squadron, 50th Special Operations Wing, interviews with an inquiry team on the *Mayaguez* incident.
11. Col Loyd J. Anders, deputy commander (operations), 56th Special Operations Wing, interviews from GAO report, 31 October 1975, 3 November 1975, and communication on 5 November 1975.
12. Message 012103Z February 1976, US commander in chief, Pacific, to Joint Chiefs of Staff, relating to the draft General Accounting Office report on the SS *Mayaguez*, para 3.0.
13. 306 Strategic Wing History, RAF Mildenhall, UK, January–June 1986, 289, 4.
14. *History of the Strategic Air Command*, 1 January–31 December 1986, (Headquarters Strategic Air Command: Historical Study 219), 8, chap. 4, 1.
15. CMSgt Carl D. Parker, *ALCE After Action Report*, Travis AFB, Calif., 60th Military Airlift Wing, 18 August 1987, 2.
16. USAF Oral History Program, interview with Gen Duane H. Cassidy, 4 August 1989, 31.
17. Ibid., 33.

18. *Aviation Week and Space Technology*, 24 June 1991, 83.

19. *Conduct of the Persian Gulf War: Final Report to Congress*, 2, April 1992, e-23.

20. Ibid., c-14; and *Conduct of the Persian Gulf War: Final Report*, appendix T, 3, April 1992, t-53.

21. *Persian Gulf War: Final Report*, 3, appendix T, April 1992, t-104.

22. Ibid., t-232.

23. *Persian Gulf War: Final Report*, 2, April 1992, c-14.

24. *Persian Gulf War: Final Report*, 3, appendix T, April 1992, t-53–54.

25. Ibid., t-105–6.

26. *Operation Desert Shield/Storm After-action Report*, 926th Tactical Fighter Group/706th Tactical Fighter Squadron (New Orleans, La.: Naval Air Station, 17 August 1991), 18.

27. *Persian Gulf War: Final Report*, 2, April 1992, c-18.

Chapter 2

Imagery and Military Deployment
The Key to Power Projection

Without reconnaissance, command and troops are blind. Reconnaissance without aerial reconnaissance, like aerial reconnaissance without aerial photographs, is inconceivable. Therefore, the task of the soldier in the Aerialphoto Service is one of responsibility and gratitude.

—Major General Keigler
Inspector of the German Reconnaissance
Fliers and the Airphoto Service

The environment in which US military forces operate places heightened demands upon intelligence resources. The demands specifically assure that adequate information is readily available to senior command leadership for situational awareness. The process of tailoring combat assets or applying force demands the delivery of a seamless perception of the entire operating environment. The commander must base projection of future events upon consideration of the widest possible analysis of intelligence collected at every level. Intelligence analysts must have immediate access to intelligence resources, or be able to poll immediately such intelligence resources which must then be tailored to meet each command requirement. Other elements of the command have unique requirements for intelligence. The Air Operations Center (AOC) must continuously track ongoing events in the theater, and, in some circumstances, beyond the command's area of responsibility, in case air power must be applied. Also within the AOC, air tasking orders are developed and continuously refined to meet changing threats. Plans must be developed and refined for diverse operations, including airlift of logistics, support to special operations forces, worldwide noncombatant evacuation operations, target development and weaponeering, and search and rescue operations. Thus, intelligence is not only essential for use by operations and intelligence applications, but must serve the planning community as well.

Fundamental US interests remain relatively stable over time, but challenges to those interests continually arise from many new and unexpected quarters. Other pressures arise which do not directly affect vital US interests; however, they cannot be left unanswered. The aggregate result may well be a decline in the US leadership position in the world community.

> US forces designed for forward presence would stress the integration of military instruments of national power with economic and political tools. Intelligence collec-

tion, drug interdiction, combined exercises, and mobile training could ultimately be more useful ways of protecting US vital interests than armored brigades, tactical fighter wings, or carrier battle groups.[1]

The reshaping of US military forces to adapt resources to a fundamentally altered world environment significantly increases the necessity to expand intelligence distribution. "Conventional forces must be able to meet a wide array of challenges while drawing from a smaller reservoir of forces. Fewer forces and a broad range of challenges mean that each individual unit must be prepared to face a wider spectrum of missions."[2] The new Air Combat Command composite air wings must be prepared to deploy and meet such challenges from any quarter. In describing short-notice, worldwide deployment responsibilities, Brig Gen William S. Hinton, Jr., commander of the 366th Wing stated, "The commander of this wing could become a JFAC [joint forces air commander] or JTF [joint task force] commander . . . it would all begin with the intervention wing."[3]

It is important to consider the general's reference to joint operations. "Although oriented toward threats in their particular theater, forward-deployed army forces must also be available to reinforce operations in other areas—as did about half of the forces in Europe for Desert Storm. With a smaller force structure, the United States can no longer afford to field forces whose utility is limited to Europe alone, or to any other single theater of operations, because of their design, equipment, training or political constraints."[4] In designing an imagery dissemination system, the US must consider the contemporary emphasis on joint service operations. Multiservice operations create an essential need for all fielded imagery dissemination systems to be fully interoperable.

US Naval forces, in the future, must be prepared to project power to distant regions of the world.

> the challenge to US interests in the Third World is now clearly more demanding of the Navy than Cold War imagination would ever have allowed. We are shifting from a highly sophisticated Soviet problem to a surprisingly sophisticated Third World problem . . . defense of the US interests may depend on the United States (and its Navy) alone. This means independent, fully capable battle groups.[5]

Naval forces, particularly carrier-based aviation and other power-projection forces, must therefore have access to the imagery intelligence data flow. Navy combat units are subject to the same short-notice demands, and accordingly, the same imperative exists to provide continuous access to intelligence data for the duration of routine worldwide deployments.

The pace at which military units may have to deploy requires emphasis. The best illustration is the time requirements placed upon the initial combat entities deploying to Desert Shield in early August 1990. Immediately following the Iraqi invasion of Kuwait, forces representing each of the US military services were tasked to respond.

> Two carrier battle groups with more than 100 fighter and attack aircraft and more than 10 surface combatant ships were directed to sail to the Gulf region on 2 August [the day of the invasion]. The carrier USS *Independence* (CV 62) battle

group sailed from near Diego Garcia to the North Arabian Sea, while the USS *Dwight D. Eisenhower* (CVN 69) battle group moved to the eastern Mediterranean in preparation for entering the Red Sea.[6]

The US Air Force received equally demanding tasking. "Twenty-four F-15Cs from the 71st Tactical Fighter Squadron, Langley AFB, Virginia, arrived in Dhahran 34 hours after receiving the deployment order, and were on combat air patrol alert four hours later."[7] Other Department of Defense components, both part of and directly supporting US Central Command, were tasked to deploy immediately to Southwest Asia.[8]

Two elements of these deployments underscore the critical need to maintain a flexible and broadly capable imagery intelligence network. First, in the case of the US Navy deployment order, combatants tasked to respond to a crisis will not likely be in their home port, and will not necessarily be in any port. Any intelligence data sent to responding units must be delivered at sea. Second, the US Air Force deployment time lines were stated in *hours*, and the supporting intelligence must be deliverable immediately to units responding, both at their assigned base and to the base to which they are deployed.

The essential element of power projection is procurement and application of precise information on all aspects of ongoing events relating to the scenario. Smaller forces with worldwide commitments, coupled with the certain possibility of short reaction time significantly increase the burden on intelligence. A wide variety of data must be quickly disseminated to power projection forces. Effective planning has an inherent requirement for the participating units to have a receive capability whether they are at sea, at forward operating bases on foreign soil, or in the CONUS (continental US) preparing to deploy.

At this point a key issue to address is what the disseminated intelligence should consist of. There are three essential ingredients for adequate support to operations. First is the current imagery of a wide range of items from targets to be serviced, installations to be protected, sites representing a threat to US or allied forces, and areas to be occupied or transited, to hostile forces to be countered. Imagery dissemination sources must be capable of processing imagery from any source, including LANDSAT and other multispectral products, simulated pave penny omnidirectional target (SPOT) and other foreign sources, and "hand-held" imagery libraries. Although high-volume imagery is essential for responding forces to tailor their strategy, imagery alone is insufficient to provide adequate situational awareness for ingressing and supporting forces.

The second ingredient is signals intelligence (SIGINT), which provides an added dimension to imagery. The importance of SIGINT is in identifying threats during combat mission planning.

> As of now, the F-15s are more vulnerable than the Air Force would like. They are equipped with capable electronic warfare (EW) systems-jammer, radar warning receiver, and chaff and flare dispensers for self-protection against enemy missiles. Those systems did well in the Persian Gulf War, enabling the fighters to come through virtually unscathed, but they still need work.[9]

Wherever possible, the system should add SIGINT to disseminated imagery through the use of overlays. These overlays, depicting latest updates of hostile force locations and threat radii from hostile weapon systems, would significantly enhance the value of the image to a wide variety of users. SIGINT would provide the user fused, correlated intelligence data on a single image. SIGINT has, by its nature, an added capability of being unaffected by weather and darkness. In the event current imagery is unavailable because of sensor or platform degradation or unavailability, SIGINT products could be disseminated alone or could be used to update previously acquired imagery from a data base.

Successful operations depend upon a third ingredient which is in the form of finished intelligence products. Government agencies, both Department of Defense (DOD) and civilian, have considerable intelligence production resources that they would tap during times of crisis or contingency. Personnel with extensive geopolitical and military order-of-battle experience have the potential to make a strong contribution to military planning and operations. Intelligence resources the agencies produce include beach studies, regional defense graphics, weapon system performance studies and recognition guides, and other information that may make a strong contribution to the effectiveness of responding forces. While in a peacetime environment, ordinary mail distribution or couriers are the most effective means of disseminating these products; during a crisis or contingency, demands for timely intelligence information may render these methods useless. Digital dissemination has the potential to place these products in the hands of the users in time for their effective use.

Some tailoring or reorganizing of national and theater intelligence agencies providing the intelligence data described previously will most likely be necessary, and a new organization may be created. In any case, the overriding requirement is that the primary element in the organizational charter must be the primacy of support to theater combat forces. Diversions of resources to competing consumers of intelligence support will deny the application of those resources to key mission objectives.

The 366th Wing, discussed previously, is a prime example of a combat unit with a requirement for immediate predeployment intelligence data. With intelligence data provided in advance of a deployment, the wing could immediately familiarize aircrews with targets and threats, conducting combat planning and escape and evasion training, and to initiate other planning as the situation dictated. Other CONUS-based forces, including special operations forces and US Army airborne forces, have equally valid requirements for intelligence support over the imagery dissemination system. Ground forces must have access to the most current intelligence information, particularly imagery intelligence (IMINT), on potential objectives, terrain features, defenses and fortifications, and landing and drop zones. Although it is important to provide timely intelligence to the garrison location of the Army and Marine forces, it is essential to provide a means of providing interim updates during the course of long-duration airlift operations. By equipping the airlift fleet with receive-only elements of the imagery dissemination system, either national or theater sources can provide the most current intelligence to forces en route to the theater. One cannot overstate the importance of current intelligence to ingressing airborne forces.

Provision of intelligence over a dissemination system serves an additional purpose beyond reducing the risk of surprise through advance preparation. It substantially reduces the duplication of effort among CONUS-based combat units in maintaining imagery and other intelligence files. Although those units will certainly maintain select data bases on key regions of the world, a dissemination system would greatly simplify the task of providing updates. As the system makes periodic updates, that same system designed to provide predeployment intelligence would, in peacetime, broadcast updated IMINT and SIGINT to system users CONUS-wide. Those units stationed overseas would also benefit from rapid access to nationally produced intelligence.

Peripheral devices such as file servers and large-capacity storage devices enable the network to operate more effectively, allow the elimination of some of the volume of storage space currently required, and save manpower needed for the analytical workload by reducing duplication of effort. Peripheral devices are discussed in greater detail in chapter 3.

Notes

1. Henry C. Bartlett and G. Paul Holman, "Grand Strategy and the Structure of US Military Forces," *Strategic Review* (Spring 1992), 46.
2. Gen Carl E. Vuono, reprinted from *Foreign Affairs*, Spring 1991. Cited from *Fundamentals of Force Planning*, vol. 2, *Defense Planning Cases*, edited by the Force Planning Faculty (Naval War College, 1991), 340.
3. Quoted in "Gunfighter Country," James W. Canan, *Air Force Magazine* 75, no. 10 (October 1992), 26.
4. Vuono, 340–41.
5. Michael Vlahos, reprinted from U.S. Naval Institute *Proceedings*, January 1991. Cited from *Fundamentals of Force Planning*, vol. 2, *Defense Planning Cases*, edited by the Force Planning Faculty (Naval War College, 1991), 446.
6. *Conduct of the Persian Gulf War: Final Report to Congress*, vol. 2, April 1992, e-24.
7. Ibid., e-23.
8. Ibid., appendix E presents a thorough summary of deployment requirements levied upon numerous Department of Defense entities.
9. James W. Canan, "Electronics for the 'Rainbow Threat'," *Air Force Magazine* 75, no. 7 (July 1992), 24.

Chapter 3

Imagery Production and Dissemination Architecture

The Right Product at The Right Place at The Right Time

Long range photography is now a fact, its drawback being the lack of detail obtained. Future developments in films and methods of enlargement will, in all probability, overcome this drawback.

Capt W. W. Wise, Memo to the Assistant Commandant, Air Corps Tactical School, 15 May 1928

One of the most pervasive challenges facing the intelligence community is accurately and consistently matching imagery dissemination with user requirements and expectations. Historically, the producer has been required to match operational user requirements with imagery acquired from a variety of unique sources. The rapid-paced dynamics of the contingency environment magnifies the complexity of the task and the not uncommon scenario where among multiple acquired images, none precisely matches the users' specifications.

Architecture

The intelligence requirements discussed in chapter 2 place rigorous demands upon an imagery intelligence dissemination system. For the system to provide adequate mission support, it must apply deliberate focus to the overall architecture and it must define the system building-block concepts. This chapter discusses the system architecture in terms of its components and their functions and position within an overall system design. Also discussed are the overall dissemination system architecture, and the four considerations important to effective system design and operation. These considerations are dissemination direction, security levels, user-access capabilities, and operations in the multinational environment. The glossary includes definitions of the four key ingredients of the potential system success.

The essential elements of power projection are procurement and application of detailed intelligence information related to the target region, countries transited by deploying forces, and other areas of interest. The system must therefore quickly disseminate a wide variety of data to power projection forces. Smaller forces with worldwide commitments, coupled with the certainty of short reaction time, significantly increase the burden on intelligence.

Dissemination Direction

The central means to maximize support to power projection forces is a high-volume data dissemination system capable of transmitting imagery products and other intelligence data from centralized production sources to CONUS-based units and theater commands. This information may reside on hard copy or on electronic or video media. Provisions must be made to effectively digitize hard copy imagery for dissemination and to disseminate video in its original form.

The data links must support the flow of intelligence data to forces tasked for deployment as well as forces considered for augmentation or serving in a support role. These include augmenting forces from all the services in the CONUS as well as those already forward deployed in other theaters.

The overall system design consists of six interactive subsystems: a national imagery transmission segment (NITS); a unified-specified command/major command receive segment (UMRS); a numbered air force air operations center segment (NAS); an operations support segment (OSS); an airborne reconnaissance support system (ABRSS); and an airborne receive element (ABRE). Combined, these blocks will afford users a flow of imagery required to support mission objectives.

The system planner must size NITS to meet crisis and contingency imagery requirements. This capability would result in an excess imagery capability during peacetime operations, but it could be used effectively for other purposes. The NITS operators could select intelligence video products, discussed in chapter two, for dissemination to any combination of commands the network serves. This would enable the command leadership to review the same intelligence information briefed to senior DOD leadership on the same day.

The NITS would transmit imagery and selected finished imagery intelligence products, graphics, and, under some circumstances, written reports to the UMRS. This high-volume system would afford direct connectivity to users based in overseas theaters as well as those stationed in the CONUS. It would enable each user to immediately access perishable intelligence information. The theater users could maximize use of centralized national intelligence collection and analysis capabilities. The NITS would relieve CONUS-based forces deployed in support of contingency operations of the redundancy inherent in each unit maintaining a detailed worldwide intelligence database.

The UMRS facilitates receipt of national imagery products by theater combatant commands and CONUS-based supporting commands for application toward theater priorities. These priorities would include providing intelligence support to force-posturing decisions, preparation of contingency data bases, target development in support of contingency planning, and other reconnaissance requirements dictated by command requirements. Each command would tailor organizational functions supported by the UMRS to meet command-unique requirements. The UMRS itself would be engineered to support two operational concepts: fixed-site or deployable. Depending upon command objectives, operational roles, and mission requirements, commands may opt for either operational concept or both.

The fixed-site UMRS would be embedded in an analysis center supporting the headquarters of the unified/specified command or major command. Permanent personnel would man the site. They would, with some exceptions, remain on-station to provide support to forces conducting contingency operations or deployed to conduct contingency operations in another theater.

Transportable UMRS units would be air-transportable and capable of independent operation at bare-base sites. Commands opting for transportable UMRS units would designate, train, and equip a mobilization cadre to deploy with and operate the UMRS.

A key difference in the two types of UMRS is that the transportable segment would not have photographic laboratory equipment normally associated with large-scale imagery production facilities. The transportable UMRS would have some production capability through the use of commercially available dry-process printers and high-speed laser photocopiers. Considerations in the selection process are airlift and land transportation limitations, potential operating site restrictions, and, most important, mission demands.

Larger commands, particularly those based in the CONUS and having extensive overseas mission requirements, may not be optimally served by a single UMRS. Operation of one of each configuration would permit uninterrupted access to national intelligence and full production capabilities while assuring the same access to deployed forces. Redundancy is an added benefit of possession of two systems.

The NAS would be operationally similar to the UMRS, yet distinguished in several ways. Its mission would differ in that it would focus on a smaller area, supporting response to the component commander's intelligence requirements. The segment would be considerably smaller and less expensive than the UMRS. The combat units supported by the numbered air force air operations center segment could deploy rapidly, and could transport and operate the NAS as an integral unit component. It would be self-sustained, in terms of both operations and spares, and capable of operating in a bare-base environment. Additionally, the NAS, with its print capability, would serve as a small-scale production facility at forward operating locations remote from the UMRS and the operations support segment.

The OSS would be a constellation of subelements that would operate from direct imagery feed from two sources. Its primary mission would be to receive, process, and exploit imagery electronically downlinked from airborne reconnaissance platforms. Secondarily, the NAS and UMRS would provide imagery through a direct digital link. Data flow between elements supported by the OSS would be bidirectional. This would facilitate imagery dissemination from sensors carried aboard weapons systems to the service component commander and to analysts at the battle damage assessment center. The OSS supports a more narrowly focused mission, and would support the service component commanders' requirements.

While the OSS directly supports the service components at the headquarters level, it will, through the NAS network, also service imagery requirements at subordinate organization levels. This means, for example, that units may be afloat with Marine Corps expeditionary forces, aboard surface ships serving power projection missions, and in flying units at deployed locations.

The ABRSS is a set of capabilities installed on reconnaissance aircraft that facilitates a direct data flow to the overall system architecture. Historically, when reconnaissance aircraft and photo processing-facilities have been geographically separated, a time-consuming courier process has been required to transport imagery for processing. Flexibility inherent in the electronic tether would facilitate placement of the imagery-processing facilities wherever needed while the reconnaissance aircraft could stage from or recover at bases independent of those facilities. The ABRSS would consist of three imagery-processing components: a digital downlink, a digital uplink, and an onboard digital imagery recorder. The unit would use the downlink to transmit imagery directly to the OSS for analysis and, if required, further dissemination. The uplink would disseminate the imagery to a variety of other communications platforms for further dissemination, and ultimately reintroduce it to the OSS. The mission planners would use the uplink in the event the aircraft must operate beyond line of sight restrictions inherent in downlink operations. Planners would also use the uplink when the mission required imagery dissemination beyond the capabilities of the OSS. The onboard recorder would store imagery acquired while the aircraft was flown beyond the range of the downlink and, when the aircraft reestablished the link, would downlink the previously acquired imagery. The recorder would have the capability to serve as a backup to the datalinks.

The ABRE design would be a simplified device modeled after OSS elements and installed in preconfigured cargo aircraft. Imagery covering paratroop drop zones, low-altitude parachute extraction system (LAPES) sites, and airfields could be transmitted to inbound aircraft. Special operations forces' missions are likely to require deployment to, and staging from, barebase or remote sites lacking secure communication facilities. Forces deploying from extended distances, particularly the CONUS, or encountering delays en route are vulnerable to arrival at a significantly altered scenario from that which the forces anticipated. Dissemination of imagery products to en route forces would reduce the risk of surprise by a changed threat environment or mission changes in noncombatant evacuation operations (NEO).

Several specific capabilities must be considered in building the overall imagery dissemination system. As stated above, those features include a two-way dissemination capability, security considerations for operating in a variety of environments, a "pull" capability, and provisions for adding on emerging technology.

Two-way dissemination would enable deployed combat units to send intelligence data to the theater command element. Such data, derived from US and allied sources, would enable the command to conduct more accurate combat assessment and to assist in the battle damage assessment process. The US Navy has, for example, reconnaissance capabilities with the TARPS-equipped F-14. However, the carrier-borne intelligence assets do not have a wide range of resources with which to validate and correlate their findings. The imagery dissemination network could be used to send the data to a centralized theater intelligence organization for thorough exploitation and dissemination to other users.

The field input to the imagery dissemination network must be designed with a flexible, open-ended architecture that will permit introduction and dissemination of imagery from new sources as system designers and engineers develop them. As the unique capabilities of special operations forces expand, so must the equipment adapt to exploit those capabilities. As an example, each of the services has teams that could be equipped with small, lightweight, man-portable still cameras. These cameras would be equipped with light-sensitive receivers instead of the typical silver film system. The receiver could be linked directly to the imagery dissemination system, or the data would be stored on magnetic tape until a link could be established. Airborne applications of such sensors show promise in circumstances where standard reconnaissance resources are unavailable. During the *Mayaguez* crisis, Lt Col Loyd Austin, who was to command the invasion of Koh Tang Island were that option selected, conducted aerial reconnaissance of the island to select helicopter landing zones. The Army twin-engine Beechcraft was not designed as a reconnaissance aircraft. However, its effectiveness in supporting that mission would have been significantly enhanced had the means been available to record findings for later replay into a dissemination system for wider distribution.[1] The key point is that as reconnaissance tools and use concepts are developed, deliberate consideration must be given to their compatibility with the means of disseminating the product.

Imagery sent across a dissemination system has the potential to significantly alter the course of conflict through use by US and allied forces, and also by interception and exploitation by hostile forces. Alternatively, imagery is perishable and becomes worthless if it cannot be placed in the hands of the user without delay. Historically, the focus has been to bring the user's access levels up to the classification level of the imagery. This is acceptable in peacetime, but under circumstances requiring immediate military action, operations may be degraded by inadequate imagery intelligence support.

Security

Consideration should be given, from a security standpoint, to adapting the imagery to the user instead of moving user accesses to higher level security caveats. Two such means are auto-sanitization and bilateral security arrangements. Auto-sanitization is a set of instructions imbedded in the imagery dissemination system software that strips sensitive data from the image which is generally useless to the user. The imagery and derived intelligence products can then be accessed at a lower classification level. Bilateral security arrangements with US allies to set access procedures for contingency use must be negotiated and agreed to in advance of contingency operations. Desert Shield offered considerable time to implement security procedures, but future conflicts may deny an opportunity to work out security procedures. Part of that process should be to thoroughly evaluate imagery sources and other intelligence collection assets to ensure that denial of access to coalition partners as well as US personnel is firmly grounded on national security protection.

Higher organizational levels of the dissemination system must have the capability to protect imagery which must remain in restricted access channels while simultaneously moving imagery of various classification levels to multiple users. Multilevel security reduces the risk of security compromises by coding each imagery product as it is entered into the dissemination system. The product would be coded with its classification level and all applicable caveats. Each user's system password, which permits access to the system, would be imprinted with the highest level of classification the user is cleared to access. Additionally, each unit would be coded with specific restrictions established on the basis of physical location. That step would prevent intelligence from being acquired in areas protected by lesser security restrictions, regardless of access permitted by the password code. The original imagery source, its origin, any added intelligence information, and intergovernmental agreements would determine access by and release to host governments or third-party nations.

Although multilevel security is widely viewed as an attractive option in system design, it does present some significant challenges. It contributes to an undesirable obstruction in the flow of intelligence to war fighters. In coalition operations, security restrictions may place US personnel at all levels in a position where partners must be excluded from some areas because of limited access. Secure work areas may be inadequate, but restrictions may require separate facilities for additional terminals, driving up costs for equipment and manpower. The equipment becomes more expensive, heavier, and more complex with the addition of multilevel security capabilities. These considerations make the avenue of wider access to intelligence one deserving careful consideration.

System Access

A particularly difficult challenge confronts the imagery planners and producers at the centralized support organization. Personnel there must accurately determine the specific imagery requirements of theater commanders, deployed field units, and naval units at sea. Often personnel must develop those requirements in the midst of the dynamics of an unfolding crisis and rapid change. A key to answering this challenge is through use of a "pull" system capability. With this capability, the end user would engage a set of parameters into the imagery dissemination system and be able to immediately review on a workstation screen all imagery acquired within the specified parameters. The parameters include geographic boundaries, quality scale rating, and date and time limits. The intelligence user at the operational level or in the mission planning cell would be able to select the imagery products best serving mission requirements. The user would immediately send the image, still in digital form, to a local printer for processing into a hardcopy print if required. "The dissemination of collected, processed and analyzed data will be more widespread and timely. More onboard collector processing and broadcast systems will send the data out to consumers in near real time from both collector and all-source organizations."[2]

The pull system must be interactive with collection managers, with whom imagery sensor tasking responsibilities lie. When users find that imagery is unavailable in the file servers they have access to, collection managers must have a means built into the system to search imagery dissemination archives for products to satisfy the request. In cases where a more thorough search was unsuccessful in satisfying a requirement, the collection managers would submit collection requirements which would serve as the basis for new collection tasking.

Multinational Environment

Allied nations with whom the US may engage in combined operations often possess unique reconnaissance capabilities which, if exploited by US and other allied nations forces, have the potential to serve as force multipliers. The use of allied military resources may satisfy tactical reconnaissance capability shortfalls arising from inventory voids, deployment delays, and competing mission priorities. This can be readily accomplished by deploying the OSS to the host base. In discussing the direction the US Navy's Space and Naval Warfare Systems Command (SPAWAR) is moving in, Rear Adm Robert H. Ailes, SPAWAR commander, stated:

> The lessons of Desert Shield and Desert Storm are being incorporated in our new systems, as in the reality that all Navy C^{4}I [command, control, communications, computers, and intelligence] systems in the future must be both *joint* (compatible with our sister services) and compatible with the systems of our potential allies and coalition partners.[3]

Such sharing also has potential for effective use in peacetime for such purposes as treaty- and armistice-monitoring and indications and warning functions. Collective security is indeed the future direction the US is moving in, and it must be supported by technological superiority.

> The United States must continue to provide the leadership necessary to encourage and sustain cooperation among our allies, friends, and new partners in meeting the challenges that we will inevitably encounter in the future. We must continue to stay engaged, thereby preventing the emergence either of a new global threat or a vacuum in a region critical to our interests.[4]

Exploitation Trends

Advances in imagery exploitation equipment continue at a rapid pace, adding considerably to the effectiveness of reconnaissance resources. The architecture at the user end of the system must be open-ended to permit adaptation of advanced imagery exploitation and manipulation equipment as it becomes available. An example of this is a soft copy imagery manipulation workstation. The user loads this device with imagery of a target area, and the device is then operated by the end user. The user has the capability to manipulate the image, changing the look angle from a high oblique or overhead perspective to a low-level perspective, or even ground level. Aircrews are able to "fly" a mission, practicing ingress and egress routes. Special operations team members can preview a target from the perspective from which they will engage it. Equipment can be added that not only will improve the image but will change the natural features, such as adding fog or mist or changing the level of daylight or darkness.

Advances in imagery dissemination can be driven further with closer involvement with industry. The burgeoning transfer of military programs to civil applications provides opportunities to exploit an economy of scale. The medical community, with ongoing advances in medical imaging, has potential to expand its imagery dissemination activities, as does the energy industry with transmission of seismic data from remote locations worldwide. Industry standards must be sought out, and off-the-shelf equipment must become the rule rather than the exception. Shared communication arrangements modeled after the Civil Reserve Air Fleet program have the potential to reduce costs. Ultimately, the goal of faster fielding at lower costs has more opportunities for success when civil industry is closely involved.

Notes

1. David R. Mets, *Land-Based Air Power in Third World Crises* (Maxwell Air Force Base, Ala.: Air University Press, July 1986), 43.
2. Maj Gen James R. Clapper, Jr., "Desert War Was Crucible For Intelligence Systems," *Signal*, September 1991, 79.
3. Rear Adm Robert H. Ailes, "Exploiting the Commercial Information-Management Revolution," *Sea Power*, April 1992, 97.
4. *National Security Strategy of the United States*, The White House (Washington, D.C.: Government Printing Office, January 1993), 13.

Chapter 4

Imagery Management
Some Challenges and Concerns

New conditions require, for solution—and new weapons require, for maximum application—new and imaginative methods. Wars are never won in the past.

—Gen Douglas MacArthur

The historical issues and system architecture associated with imagery dissemination and intelligence support to the user are clear; however, some cautions and challenges must be addressed. The areas wherein problematic issues are likely to arise are the organizational structure of imagery exploitation organizations, training imagery personnel for combat support, and communication support for imagery dissemination systems. Major commands should consider the potential impact of each of these issues, which may be topics worthy of future study.

Intelligence organizations, in general, have a significant historical data base on which organizational and operational procedures have or have not been successful. Considerable thought must be given to two aspects of the forthcoming changes in imagery dissemination. First, intelligence organizations should conduct a thorough review of how imagery is currently being processed and exploited in the organization and how the customer uses it. Second, resources must be assessed in terms of the ability to receive and process the flow of imagery through the entire dissemination system from peacetime requirements across the spectrum through crisis to war. The absence of adequate plans may cause an organization to be overwhelmed with imagery, requirements from users, and shortages of personnel.

Collection requirements managers are the focal points for the users to state and justify their requirements. It is not uncommon in many intelligence organizations for the collection requirements managers to be assigned to divisions or branches external to imagery processing and exploitation. Often the managers are further removed—functionally assigned external to the organization. These assignments are made because of the "all-source" focus on intelligence collection management. The collection requirements managers' expertise must extend beyond the capabilities of the collection systems. It is of paramount importance for the collection requirements managers to be constantly aware not only of current outstanding requirements and work orders pending completion but also of the capabilities and products of the imagery intelligence facility.

Peacetime and contingency plans must, like any other combat plans, be given the advantage of robust testing in exercise scenarios. Such testing should evaluate operational procedures and command and control functions, but must also focus on the impact of the test on internal and external logistics support. The intelligence organization depends upon timely replacement of supplies required for imagery production as well as for spare parts. However, contingency consumption forecasts should be established in advance, as should alternative logistics sources.

Exercises must extend beyond the intelligence organization into the Air Operations Center. A specific problem that managers must consider is the dissemination of imagery to numerous users, including combat assessment and battle damage assessment cells and battle staff organizations. To maximize their effectiveness, these entities must have rapid delivery of imagery.

Maximum effectiveness of the imagery demands that it be analyzed by personnel with skills and experience in imagery intelligence. Additionally, in some circumstances, the user must correlate other intelligence data with imagery. A strong potential for problems then arises when the imagery organization must furnish imagery analysts to other agencies. These agencies use the analysts in evaluating imagery at their respective node in the secondary dissemination system. Such tasking would come at a time when imagery throughput would most certainly be increased by a significant margin, with an accompanying increase in the level of exploitation and reporting required. Commands must resolve this dilemma and tailor personnel tasking consistent with unique command requirements.

The advanced technology required to support imagery presents a special challenge to intelligence organizations' leaders. Command restructuring and downsizing may present a tempting option to centralize some of the support functions at a higher organizational level or perhaps to relocate them to a base-level unit. Care must be taken to maintain an uninterrupted high level of support. As an example, competent, dedicated personnel perform base-level computer programming support, but challenges and limitations may quickly emerge in three areas.

First, a long lead time stands between a computer programmer and a necessarily high level of proficiency in working with computer-aided intelligence data bases and exploitation and reporting systems. Second, the absence of internal computer programmers requires the intelligence organization to compete with other supported agencies at the base level. This is a particularly arduous problem during crises because it may be difficult, due to security restrictions, to convey the urgency of providing immediate support. At other times, supporting agencies may regard the intelligence organization as simply another customer and do not understand the importance of the intelligence data provided to senior leaders. This unfortunate circumstance may even be found within larger intelligence organizations where a sought-after economy of scale results in centralization of support functions.

The third area of concern is the ability to remain abreast of rapid changes taking place in electronic data processing. One of the most effective ways to maintain an effective body of knowledge in the state of the field is through representation at program office-hosted users conferences and factory design review and evaluation, acceptance testing, and other related events. Convincing the supporting organization of the need to spend travel funds and to endure the temporary absence of some of their most talented people may be extremely difficult. Considering that the direct return to the organization is not highly visible and that other supported agencies may present similar competing demands getting approval may be an issue. Thus, the intelligence organization misses a window for acquiring valuable information on current and planned system configuration, operational, and maintenance data. The organization also misses an opportunity to impact the direction of ongoing system design changes to suit command-specific and common user requirements.

The area of training is one that will require significant emphasis in the future. The demise of the Soviet bloc, the significant challenges of weapons production, trade, and proliferation in the third world, and sustained world leadership by the United States strongly imply prolonged, and perhaps increased, worldwide military involvement. No longer will imagery analysts be able to maintain familiarity with Warsaw Pact military equipment only. Now they must be able to quickly and accurately identify a wide variety of military equipment. Such equipment may be manufactured and marketed by the United States' friends and foes, and by neutral states worldwide as well as by multinational corporations. Further, equipment modification by the end user to meet specific operational requirements may change some of the identification signatures visible to the imagery analyst. Considering the cost in manpower and materials for each analytical organization to develop and maintain organic imagery analysis keys, a central agency should be identified and tasked for development and maintenance of soft copy imagery analysis keys. Central management of imagery analysis keys would be beneficial in two ways.

First, duplication of effort would be nonexistent, and a burden on major commands would be significantly reduced. A unit would develop keys and disseminate them worldwide via the primary and secondary dissemination systems. Second, in the event of crisis or hostilities where an adversary concurrently introduced new weapons systems, advisories and imagery analysis keys could be immediately disseminated to all commands with potential participation in the action.

Communications is an area of concern because the flow of intelligence information is central to success both in planning and conducting military and naval operations. "Effective C^3 [command, control, and communications] systems are vital to planning, mounting, and sustaining a successful joint operation. Operations, logistic, and intelligence functions all depend on responsive C^3—the central system that ties together all aspects of joint operations, and allows commanders and their staffs to initiate, direct, monitor, question, and react."[1] This study addresses communications issues on three fronts.

1. Imagery dissemination to combat units worldwide demands a high-volume, survivable communications flow. It is essential that an uninterrupted imagery movement service warfighters. The Gulf War tested US communications equipment under extreme conditions, but the results revealed flaws which, under other circumstances, could have proved pivotal to a successful engagement. "Communication problems were . . . encountered between the US Navy and Air Force, and between units of the US Army using different generations of communication hardware."[2] This problem went beyond forces on the ground.

> In space, the lack of orbiting capacity on the US Defense Satellite Communications Systems (DSCS) presented allied forces with serious problems. Prior to the invasion of Kuwait, the one satellite giving area coverage in the Gulf was already three years past its original design life. As preparations for Desert Storm mounted, a second DSCS satellite was repositioned to act as a backup for the allies. This vehicle was also beyond its design life. . . . It is . . . estimated that up to 25 per cent of capacity had to be provided on commercial systems such as Intelsat and Inmarsat.[3]

Commanders must engage in a constant parallel effort to levy communications requirements and specifications to ensure that capabilities match the fielding pace of imagery dissemination systems.

2. Imagery dissemination systems, as well as communications systems, must support a two-way data flow. Scenarios may evolve wherein the only imagery available for time-critical battle damage assessment will be from sensors operating from deployed locations where courier movement of imagery cannot be adequately accomplished. Examples of such imagery sources are carrier-based reconnaissance platforms and reconnaissance drones operated by either the US Army or Air Force. Imagery from those and other sources must be made available to the theater commander immediately. By digitizing and disseminating the imagery products, decisions affecting force employment can be made on the basis of sound information. Dissemination of imagery will be forced to compete with a wide variety of other communications demands. This problem will be particularly severe with naval forces, where the communications pipeline is limited and not readily expandable.

3. External communications organizations generally serve intelligence organizations well. Circuit failures and other unscheduled system interruptions are typically uncommon, and, when they occur, tend to be of short duration. Intelligence producers, particularly those with an indications and warning mission, have, at a minimum, an obligation to remain knowledgeable of the end-to-end path of data from the intelligence source to their respective unit. Intelligence producers must also keep cognizant of the agencies that maintain each segment of that path. This is essential because the path may pass through circuits operated by other US service agencies and by host-nation personnel in the case of organizations overseas. These agencies may not sense the urgency of immediate restoration of their segment of the circuit and may have no idea what type of data passes through their segment. Informal interaction between supported intelligence personnel and supporting communication personnel will provide an opportunity to reinforce the importance of the

intelligence data flow; facilitate an educated determination of whether a failure is in a segment whose restoration is within the unit's range of influence; and help coordinate scheduled maintenance downtime to minimize mission impact.

Imagery intelligence, when serviced by highly capable dissemination systems and exploited by organizations tailored for both analysis and dissemination to users, has the potential to have far-reaching impact upon force posturing, crisis response, and contingency operations. The challenges are to design and field a system capable of supporting all users in peacetime and wartime. Moreover, it is essential that all imagery dissemination systems support each service component in a joint environment and provide high standards of support of service-unique mission demands. Each service component will certainly have a critical role in the successful pursuit of America's interests. Planners must pay careful attention to allied interoperability. Increased focus will certainly be given to burden-sharing with allies as budgets continue to diminish and new alliances are formed.

Notes

1. Joint Publication (Pub) 6-0, *Doctrine for Command, Control, and Communications Systems Support to Joint Operations*. Test Pub, 12 June 1990.
2. "Communications Problems in Gulf War," *Asia-Pacific Defence Reporter*, April–May 1992, 40.
3. John Williamson, ed., *Jane's Military Communications, 1992–1993*, 13th ed. (Alexandria, Va.: Jane's Information Group), 15.

Glossary of Key Terms

Connectivity. The capability of imagery dissemination systems to communicate with other devices sharing a common function. This capability requires communication through common protocols and interoperable cryptological devices to readily move imagery and imagery-derived products to end users.

Deployability. The quality that encompasses a capacity for timely movement in terms of airlift requirements, special handling equipment, and capacity for operation independent of ground support. Deployability of each component of the imagery dissemination system must be evaluated in terms of time, equipment, and manpower required to prepare for deployment and to establish operations at deployed locations; and in terms of the capability to operate from austere locations. A component-unique set of standards should be developed for each part of the overall system because of the varying complexities and capabilities of each.

Flexibility. The concept related to the imagery dissemination system's capability to fulfill user requirements as new imagery requirements develop and capabilities mature. Examples of these concepts are workstations capable of overlaying signals intelligence input from multiple sources over imagery products, data links capable of transmitting imagery directly to the fighter cockpit, and adaptations to new-generation intelligence production equipment.

Multilevel Security. The process by which an imagery data processing system affords security protection at a variety of classification levels in varied security environments. The process facilitates wide use of imagery protected at various classification levels in varied physical locations at workstations accessed by personnel with varying levels of security classification. The goal is to give intelligence data the widest dissemination possible consistent with regulations, policies, and protection of intelligence data, sources, methods, plans, and operations.

Text-capable. The ability of the primary dissemination to digitize and selectively disseminate textual data across the system. Also included in this concept is the ability of the receiving segment to switch rapidly between imagery printers and paper printers.

Usability. The concept of end-user interaction with and tasking of the overall imagery intelligence system and its products. It addresses user ability to readily acquire selected imagery products necessary to meet mission requirements. Training and experience are key aspects of the concept of usability. The measure of merit applicable to this term incorporates relative ease of operation with a minimum of specialized training and experience.

Bibliography

Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force*, 2 vols., March 1992.

Anders, Col Loyd J., deputy commander (operations), 56th Special Operations Wing. Interviews with inquiry team on *Mayaguez* incident, 31 October 1975 and 3 November 1975; and communication on 5 November 1975.

Artillery Report for April 1917 [German] Reconnaissance Flight 39, April 1917.

Aviation Week and Space Technology, 24 June 1991.

Bartlett, Henry C., and G. Paul Holman. "Grand Strategy and the Structure of US Military Forces." *Strategic Review*, Spring 1992, 46.

Canan, James W. "Gunfighter Country," *Air Force Magazine* 75, no. 10 (October 1992).

________ "Electronics for the Rainbow Threat," *Air Force Magazine* 75, no. 7 (July 1992).

Cassidy, Gen Duane H. USAF Oral History Program. Interview with inquiry team on *Mayaguez* incident, 4 August 1989.

Cheney, Dick, secretary of defense. Excerpts from statement before the House Appropriations Defense Subcommittee in connection with the FY 92–93 budget for the Department of Defense, 19 February 1991. Cited from *Fundamentals of Force Planning*, 2, *Defense Planning Cases*. Edited by the Force Planning Faculty, Naval War College.

Conduct of the Persian Gulf War: Final Report to Congress. Vol 2, April 1992.

Goddard, Col George W. *History of Air Materiel Command Support of the Far East Air Force in the Korean Conflict, June–November 1950*. Vol. 4, 8 November 1950.

Haney, Maj Denis J. *Tac Recon Support of Other Services in SEA*, commander in chief, Pacific Air Forces, message 290012Z May 1968. Cited from *CORONA HARVEST, An Examination of the USAF Reconnaissance Support for Surface Forces in South Vietnam*, May 1971.

History. 306 Strategic Wing, RAF Mildenhall, UK: January–June 1986.

History of the Strategic Air Command, 1 January–31 December 1986, Historical Study 219. Offutt AFB, Neb.: Headquarters, Strategic Air Command.

Intelligence Activity Input, Task: Intelligence Dissemination, 1 January 1962 to 31 March 1968. Headquarters, Pacific Air Forces: Deputy Chief of Staff/Intelligence.

LoPresti, Lt Col Thomas T. *The JCS System Before and After Goldwater-Nichols*. Carlisle Barracks, Pa.: US Army War College, May 1991.

Message. 012103Z, US commander in chief, Pacific, to the Joint Chiefs of Staff, February 1976. Message relating to the draft General Accounting Office report on the SS *Mayaguez*.

Mets, David R. *Land-Based Air Power in Third World Crises*. Maxwell AFB, Ala.: Air University Press, July 1986.

Miller, Capt Charles T. Testimony before House Committee on Internal Affairs, Subcommittee on International, Political and Military Affairs, 25 July 1975.

Operation Desert Shield/Storm After-action Report. 926th Tactical Fighter Group/706th Tactical Fighter Squadron. New Orleans, La.: Naval Air Station, 17 August 1991.

Parker, CMSgt Carl D. *ALCE After Action Report*. Travis AFB, Calif.: 60th Military Airlift Wing, 18 August 1987.

The SS Mayaguez Seizure: An Evaluation of Intelligence Factors. Hickam AFB, Hawaii: Commander, 548th Reconnaissance Technical Group, 17 June 1975.

US Air Force Operations in the Korean Conflict, June 25–November 1, 1950, USAF Historical Study 71. Maxwell AFB, Ala.: USAF Historical Division, Air University.

Vlahos, Michael. Reprinted from U.S. Naval Institute *Proceedings*, January 1991. Cited from *Fundamentals of Force Planning*. Vol. 2, *Defense Planning Cases*. Edited by the Force Planning Faculty, Naval War College, 1991: 446.

Vuono, Gen Carl E. Reprinted from *Foreign Affairs*, Spring 1991. Cited from *Fundamentals of Force Planning*. Vol. 2, *Defense Planning Cases*. Edited by the Force Planning Faculty, Naval War College.

Walls, Capt Barry W. and Capt Paul L. Jacobs, 40th Air Rescue and Recovery Squadron, 50th Special Operations Wing. Interviews with inquiry team on *Mayaguez* incident, 12 May 1975.